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Fountain Coding in Ad Hoc Wireless Networks

Professor Ben Allen and Dr Vladimir Dyo
University of Bedfordshire
Department of Computer Science and Technology
Ben.Allen@beds.ac.uk
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Background

Traditionally wireless networks communicate with users via basestations. An alternative architecture is an ad hoc network that self-forms between users and has the advantage of not requiring basestation infrastructure. It can therefore operate when there is no infrastructure available, which is possible after a disaster such as an earthquake or fire, for example [1]. Ad hoc networks may be incorporated as a key communication mode in 4G mobile networks [2]. Ad hoc networks often use an 'acknowledgement' based protocol to ensure quality-of-service, which is akin to that used by TCP/IP for internet communications. This protocol incurs a delay whilst the confirmation messages are exchanged and packets re-transmitted as required [3]. This delay makes real-time communications such as voice difficult to achieve. An alternative is to use coding to increase the robustness to errors thus reducing the requirement for an acknowledgement mechanism. Traditionally coding is applied to manage errors within a packet, and a powerful example is the Turbo code family. Coding may also be applied between packets so that missing or corrupted packets may be managed so long as the requirements are within the constraints of the available information. An example is the Fountain code family [4] that can operate in conjunction with traditional channel codes but has certain qualities giving potential for employment in ad hoc wireless networks. The aim of this PhD is to investigate innovative means of achieving real-time communications over an ad hoc wireless network by using Fountain coding, and more specifically as a novel means of message routing.

Programme

The aim of this PhD is to an innovative application of Fountain coding to ad hoc wireless networks. The programme is a rich blend of theory, computer simulation and experimentation and has the following milestones:

i. report of prior art (6 months)
ii. analysis of candidate solutions and transfer report (12 months)
iii. results from performance modelling and 2nd year report (24 months)
iv. experimentation using a suitable ad hoc wireless development platform (30 months)
v. thesis submission (36 months)

Impact potential

The researcher is encouraged to publish in leading academic journals. Examples relevant to this programme of study are: IEEE Transactions on Wireless, IEEE Transactions on Vehicular Technology and IET Communications.

The researcher is encouraged to develop exploitable outputs. Examples pertinent to this programme of study are: concept demonstrator for use in attracting further investment and patenting of novel techniques.

References

[1] ?
[2] ?
[3] ?

[4] MacKay, D.J.C, “Fountain Codes”, IET Communications, **Vol.** 152, Iss. 6, pp 1062 - 1068